

## Rebuild Hawaii Consortium

May 23, 2006

HEI Training Room, 8<sup>th</sup> Floor

American Savings Bank Building

### **Update on the Cost/Benefit Analysis of Green vs. Conventional Construction**

Analysis of Economic, Environmental and  
Occupant Benefits of  
Sustainable Design and  
LEED Certification  
For State of Hawaii and K-12  
Public School Facilities

Solicitation No. RFP-05-01-SID



# CHOI

*Architecture*

*Interior Architecture*

*Sustainable Design*

*Planning*

*Research*

**LEED™ Accredited  
Professionals**



## STUDY TASKING:

- Determine E/O/E Benefits Of Sustainable Design For New DOE Schools
- Case Study of E/O/E Benefits WIS Cafeteria Project
- Case Study of E/O/E Benefits for a Sustainable Renovation of a Standard DOE Classroom
- Implementation Recommendations



## Project Team:

**Ferraro Choi**  
Honolulu, HI

**Lincolne Scott, Inc.**  
Honolulu, HI

**RMI/ENSAR**  
Boulder, CO

**O'Brien & Co.**  
Bainbridge, WA



Working Group  
Review  
Committee:

**DBEDT**  
**DOE**  
**DAGS**  
**HECO**  
**UH**  
**Punahou School**



## Study Schedule

Months	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Year	2005								2006								2007								
Months	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M
Tasking																									
Task 1	Establish Working Group Working Group Meeting No.1																								
Task 2									Task 2 (7 Months)																
Task 3									Task 3 (7 Months)																
Task 4									Task 4 (7 Months)																
Task 5																	Prep 1st Draft								

## STUDY TASKING:

Determine E/O/E Benefits  
Of Sustainable Design  
For New DOE Schools



## Standard DOE Elementary School

Model Elementary School - DOE Standards

Created: April 6, 2006

Design Enrollment: 550

Updated: April 18, 2006

Element	Group	Qty	DOE Size(Net)	DOE Size(Net)	Grossing	Size(Gross)
General Classrooms	1	24	980	23,520	1.25	29,400
Self Contained Classrooms	1	4	1,500	6,000	1.25	7,500
Resource Classrooms	1	3	980	2,940	1.25	3,675
Administrative Center	2	1	7,380	7,380	1.25	9,225
Library Media Center	3	1	5,995	5,995	1.25	7,494
Cafetorium/Multi-Purpose	4	1	9,210	9,210	1.25	11,513
Food Service Kitchen - Conventional	5	1	2,632	2,632	1.25	3,290
Custodial Service Center	5	1	500	500	1.25	625
Faculty Center	2	2	980	1,960	1.25	2,450
Computer Resource Center	3	1	1,200	1,200	1.25	1,500
Itinerant	1	1	330	330	1.25	413
<b>Total Building Area</b>				<b>61,667</b>		<b>77,084</b>
<b>Campus Size (Acres)</b>		<b>12</b>	<b>43,560</b>			<b>522,720</b>
<b>Parking Stalls/Area</b>		<b>80</b>	<b>300</b>			<b>24,000</b>
<b>Other Hard-Surface Areas</b> (Walkways, Play Surfaces, Roadways)					Say	<b>26,000</b>

## Base Case LCC

## Green Case LCC

BASE CASE OUTPUTS (PRESENT VALUES)		
Total, All Buildings Plus Site		
<hr/>		
Total Net Present Value (Building and Site):	\$51,945,195	
Total Up-Front Cost (Building and Site):	\$30,660,062	
<hr/>		
<b>BUILDING EXPENSES</b>		
<b>ADMINISTRATION, DESIGN, AND ENGINEERING</b>		
	Total \$	\$ / SF
Project Administration	\$427,815	\$5.55
AE Design - Basic Services	\$1,711,259	\$22.20
AE Design - Special Services	\$0	\$0.00
Consulting Authority	\$0	\$0.00
LEED Certification	\$0	\$0.00
TOTAL	\$2,139,074	\$27.75
<hr/>		
<b>CONSTRUCTION COSTS</b>		
	Total \$	\$ / SF
Site	\$7,708,375	\$100
Construction Waste Disposal	\$325,419	\$4
Shell	\$8,479,213	\$110
MEP	\$6,552,119	\$85
Fit-Out	\$5,595,983	\$73
Green Building Cost Premium	\$0	\$0
TOTAL	\$28,620,988	\$370
<hr/>		
<b>REPLACEMENT COSTS</b>		
	Total \$	\$ / SF
Replacement Cost 1	\$25,543	\$0.34
Replacement Cost 2	\$9,431	\$0.11
Replacement Cost 3	\$4,773	\$0.06
Replacement Cost 4	\$8,431	\$0.11
Replacement Cost 5	\$9,955	\$0.13
Replacement Cost 6	\$10,501	\$0.14
Replacement Cost 7	\$0	\$0.00
Replacement Cost 8	\$0	\$0.00
Replacement Cost 9	\$0	\$0.00
Replacement Cost 10	\$0	\$0.00
TOTAL	\$77,003	\$1.00
<hr/>		
<b>OPERATIONS AND MAINTENANCE</b>		
	Total \$	\$ / SF
Cost of Electricity	\$35,281	\$0.46
Site Lighting	\$0	\$0.00
Interior Lighting	\$395,029	\$5.14
Ceiling Fans	\$7,096	\$0.09
MUSIC	\$1,949,876	\$25.39
Plug Loads	\$174,758	\$2.23
Hot Water	\$12,650	\$0.16
Other	\$10,584	\$0.14
TOTAL	\$2,894,531	\$36.00
Gas	\$0	\$0.00
TOTAL	\$104,666	\$1.36
<hr/>		
Cost of Oil	\$0	\$0.00
TOTAL	\$7,840	\$0.10

GREEN CASE OUTPUTS (PRESENT VALUES)		
Total, All Buildings Plus Site		
Total Net Present Value (Building and Site)	\$49,707,342	
Total Up-Front Cost (Building and Site)	\$31,515,991	
<b>BUILDING EXPENSES</b>		
ADMINISTRATION, DESIGN, AND ENGINEERING		
	Total \$	\$ / SF
Project Administration	\$427,815	\$5.55
AE Design - Basic Services	\$1,711,259	\$22.20
AE Design - Special Services	\$205,210	\$3.70
Consulting Authority	\$205,210	\$3.70
LEED Certification	\$205,210	\$3.70
TOTAL	\$2,994,704	\$38.65
<b>CONSTRUCTION COSTS</b>		
	Total \$	\$ / SF
Site	\$7,708,375	\$100
Construction Waste Disposal	\$325,419	\$4
Shell	\$8,479,213	\$110
MEP	\$6,552,119	\$85
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TOTAL	\$0	\$0.00
Gas	\$0	\$0.00
TOTAL	\$0	\$0.00
Cost of Oil	\$0	\$0.00
TOTAL	\$0	\$0.00

## Case Studies of 12 Sustainable Schools For Corroboration of Benefits

Case Study Overview: Clearview Elementary School

April 14, 2006

### CLEARVIEW ELEMENTARY SCHOOL

Hanover Public School District  
Hanover, Pennsylvania

The Clearview Elementary School is a 43,000 square foot facility that serves kindergarten through 4<sup>th</sup> grade. Designers used computer models to help maximize Clearview Elementary School's energy efficiency and daylighting and minimize its environmental impacts. The innovative geothermal heating and cooling system uses the constant temperature of the Earth to cool and heat the building.



Credit: Jim Schafer

The building's passive solar design enhances winter heating and summer cooling. Clearview Elementary School class room wing is oriented along an east-west axis to increase the overall amount of daylight.

#### Green Features

- Innovative geothermal heating and cooling system
- Daylit classrooms
- Lighting controls
- Energy-efficient lighting fixtures and ballasts
- 40% reduction in energy use
- Low-flow showerheads, mechanical push button faucet controls and waterless urinals
- 30% reduction in water use
- A building integrated sundial

#### Awards

- U.S. Green Building Council LEED-NC, v2 2004: Gold
- Clearview Elementary School was one of the buildings selected to represent the United States team in the 2002 Green Building Challenge



Credit: Jim Schafer

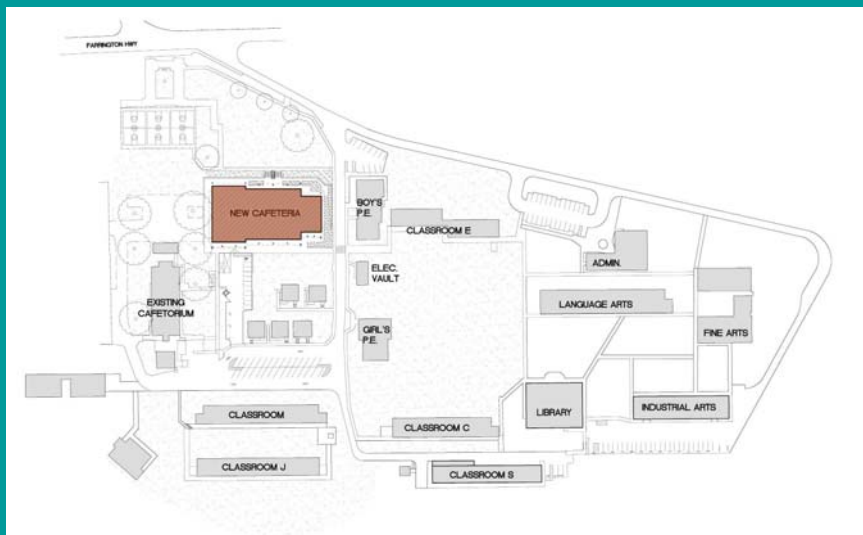


## STUDY TASKING:

### Case Study of E/O/E Benefits for Waipahu Intermediate School Cafeteria Project

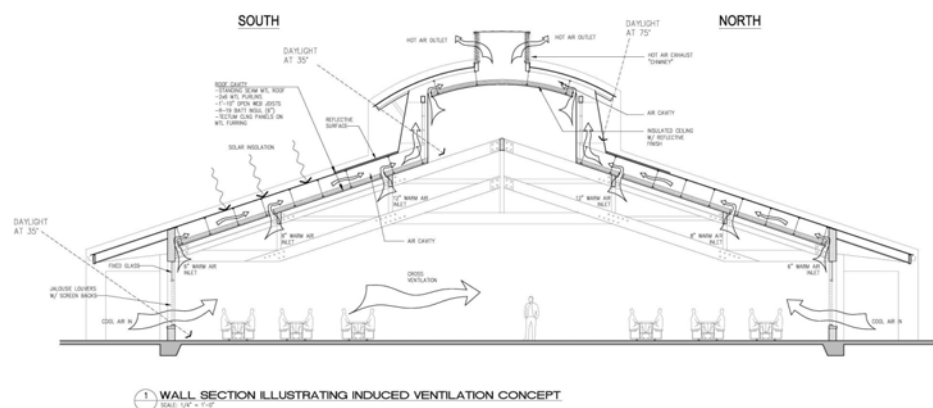


Project Size/ Construction Cost: 20,000 SF/\$5.7M  
Client: State of Hawaii, Department of Education  
LEED Certification Level Sought: LEED™ Certified  
Completion Date: May 2006  
Contractor: Okada Trucking





**Primary Energy Conservation Strategies:**  
**Daylighting Instead of Electric Lighting**  
**Effective Natural Ventilation Instead of Ceiling Fans**



Economic and Occupant Benefits: Daylight and Passive Ventilation  
Increase Occupant Comfort and Reduce Energy Consumption by 20%



Environmental Benefit: 95% of Construction Waste  
Diverted from Landfill





## LEED Score Card for E-O-E Benefits LEED™ Scorecard of 5/19/2006

[illegible]

## Case Study of E/O/E Benefits for a Sustainable Renovation of a Standard DOE Classroom

## Selected Case Study: Campbell High School in Ewa Beach



## STUDY TASKING:

### IMPLEMENTATION RECOMMENDATIONS

- Projected Saving/Benefits
- Project Funding
- Consultant Selection
- Facility Planning
- Implement Green Design
- LEED Certification
- Special Funds
- LEED Parameters
- Transitional Issues
  - Training
  - Phasing



## Work in Progress

### DATA GATHERING ANALYSIS

### SUMMARIZE FINDINGS

### MEET WITH WORKING GROUP IN MID-AUGUST

### FINAL REPORT IN FEBRUARY 2007



**Rebuild Hawaii Consortium**

May 23, 2006

HEI Training Room, 8<sup>th</sup> Floor

American Savings Bank Building

**Update on the  
Cost/Benefit Analysis of  
Green vs. Conventional  
Construction**

**QUESTIONS?**

